



PATENT SPECIFICATION

488,666

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COMPLETE SPECIFICATION

Improvements in and relating to Regenerative Breathing Apparatus for Protection against Fumes, Powders and Noxious Gases

I, HIPPOLYTE ALBERT MARCEL REGNAULT, a French Citizen, of 94, rue Saint-Dominique, Paris, France, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to improvements in regenerative breathing apparatus for protection against noxious fumes, smoke, dust and gases in which the air regenerator comprises a casing wherein a regenerator cartridge for the exhaled air is disposed in a readily detachable manner, and is characterised in that the said cartridge is formed of a box containing an oxygen-generating substance, such as a mixture of oxylith and pumice stone in granular form and also a substance which absorbs carbon dioxide, such as soda lime, means being provided for passing a predetermined proportion of the exhaled air directly into the mixture of oxylith and pumice stone and subsequently through the soda lime, and for passing the remainder of the exhaled air directly and solely through the soda lime.

The inlet and outlet orifices of the regenerator cartridge comprise closure means which are opened automatically when said cartridge is brought into the operating position in the regenerator apparatus.

In order to effect a cooling of the regenerator cartridge during its operation, said cartridge is placed in a casing or radiator comprising appropriate perforations, a perforated metal wall which is a good conductor of heat coming into contact with the outer wall of the regenerator cartridge for increasing the cooling effect.

Means are provided for maintaining the regenerator cartridge in the apparatus in a position in which said cartridge is not in service.

The present invention comprises also a certain number of special points, which will appear in the following text, reference being made to the accompanying drawing, given by way of example only, in which:—

Figure 1 shows diagrammatically in elevation a form of construction of a respiratory apparatus of protection.

Fig. 2 shows in elevation and on a larger scale a form of construction of the regenerative breathing apparatus.

Fig. 3 is a diagrammatic section along the line III—III of fig. 2, the regenerative breathing apparatus being in an intermediate position of non-operation.

Fig. 4 is a cross-section on the line IV—IV of fig. 3, the regenerative breathing apparatus being in position.

Fig. 5 is a section on the line V—V of fig. 2, showing more especially the device for the maintenance and fixing of the regenerative breathing apparatus in the interior of the case or radiator.

Fig. 6 is a partial section on the line VI—VI of fig. 2, showing more particularly the automatic valve.

Fig. 7 is a similar view to fig. 6 showing the construction of a cock worked by hand.

Fig. 8 is a section on the line VIII—VIII of figs. 3 and 4.

Fig. 9 shows diagrammatically a construction of the reinforcement for providing the rigidity of the gas mask surrounding the head of the wearer.

The protective apparatus shown is composed of a hooded jacket, formed by a blouse 1, in linen or other fabric made impermeable by any suitable means so as to be tight to gases, powders or noxious vapours, which is integral with a hood 2, alike of fabric made impermeable, but which is made specially rigid and maintained on the shoulders of the user by a suitable metallic reinforcement 3. This reinforcement 3 may be formed as shown in fig. 9 of a certain number of metal strips or wires suitably curved and connected together by soldering for example to form a cage surrounding the head of the wearer once the gas mask jacket is in place. The lower strip 3a is shaped to rest on the shoulders of the wearer so that the entire reinforcement 3 rests on the said shoulders. Moreover, this hood has on its front face an inspection window 4, which is packed in an air-tight manner by means of a transparent wall made of

mica or the like. The jacket 1 is made fast at the waist and the wrists by any suitable means to ensure gas-tightness, such as belts, elastic or the like 5.

- 5 On the jacket 1 there are fixed the respiratory apparatus proper formed, in the example shown, by a filtering cartridge 6 of any suitable type and by a regenerative apparatus which will be described below.

The filtering cartridge 6 will not be described in more detail, since it can be of any well-known type used for example for the gas masks at present employed.

- 15 This filtering cartridge 6 is fixed in a gas-tight manner on the hooded jacket 1 in any suitable way, and for preference in the vicinity of the mouth of the user.

- 20 There will now be described in more detail the regenerative breathing apparatus combined with the hooded jacket. This regenerative breathing apparatus permits the respirator apparatus to work on the so-called closed circuit principle, or in other words the air exhaled by the user is regenerated, that is to say, re-oxygenated, and it is then again inhaled by the user, the hooded jacket forming, for the example of construction described and shown, a respiratory reservoir.

- 25 The user could be provided with a simple mask of the type of those used at the present time, a gas-tight auxiliary reservoir placed on the back of the chest of the user being then adopted to form the respiratory reservoir. In all cases, however, the receptacle forming the reservoir is filled with regenerated air which is freely inhaled by the user. In other words, the user exhales the foul air directly into the regenerative breathing apparatus, from which the regenerated air goes into the said reservoir formed either by the hooded jacket or by an auxiliary reservoir of any suitable construction, rigid or flexible. The applicant has in fact noticed that the wearing of a respiratory apparatus was greatly facilitated, if the user made use of the exhalatory force for passing the foul air into the regenerative breathing apparatus instead of making use of the force created by the inhalation.

- 30 For this purpose, the regenerative breathing apparatus includes two rigid tubes 7 and 8 which are fixed, in the example shown, on the jacket 1 in a gas-tight manner, and for example by fastening the fabric between two discs 9 and 10 integral with the ends of the sections forming the pipes 7 and 8, the fastening of the said discs being effected by bolts, rivets or the like 11. One of the tubes or exhalation tube 7 is prolonged by a

70 piping 12, preferably flexible, placed in the interior of the jacket, to which it is or not connected up, and the free end of which comprises a mouthpiece of suitable form, fitted for example with two lateral projections, which come to rest behind the teeth of the user. The other pipe 8 ends in the jacket 1 or it is connected to the auxiliary reservoir which forms the respiratory chamber.

75 The regenerative breathing apparatus proper is composed of a casing or radiator and of a regenerating cartridge, which will now be described.

80 The radiator is formed by a metallic box 13 of prismatic shape, which is open at the lower end, and on the upper wall 14 of which there are fixed, by any suitable means and for example by soldering, the tubes 7 and 8, which are prolonged in the interior of the box 13 and at a certain height, to terminate in a toothing 15, the purpose of which will be explained later on. This box 13 has in its upper part perforations 16 and, internally, a corrugated metal sheet or the like 17, which is a good heat conductor, and on which there rests, once in position, the external wall 18 of the regenerating cartridge, so as to facilitate the cooling of this latter.

90 This regenerating breathing cartridge of prismatic shape is composed of a case 18 air-tight in principle, having at its lower part a spring 14a in the shape of an inverted arch forming a groove 15a along the longitudinal axis of the casing 18. The case 18, introduced completely into the radiator to be in its working position, is kept in place by a stirrup 19 which is pivoted at its ends on the radiator 13. There may likewise be used a rigid band 14a in which case the stirrup 19 is slightly flexible. The case 18 has moreover, on its front side face, a bracket 20 which can engage in a seat 21 which is present in the centre part of a leaf spring 22, one of the ends of which, and for preference the lower end, is fixed by any suitable means on the internal face of the radiator 13. A button or the like 23, fixed on the said spring 22, preferably at the right of the seat 21 and projecting outside the said radiator 13, enables the spring 22 to be pulled, so as to release the bracket 20 from the seat 21 of this spring and permit the removal of the cartridge.

100 This cartridge is provided internally at its lower and upper part with two metallic sheets or the like 24 and 25, between which there is arranged the material giving off oxygen such as oxylith in granular form, which may, in accordance with the invention, be mixed with pumice stone or the like, likewise in

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granular form, in order to facilitate the passage of the air to be regenerated. Between the upper wall of the cartridge and the upper metallic sheet 25 there is
 5 placed a product which absorbs the carbonic acid contained in the exhaled air, such as soda lime or the like. The upper wall of the cartridge has two perforations 27 and 28, into which there penetrate,
 10 once the cartridge is pushed into the radiator, the toothed ends of the tubings 7 and 8. Opposite the perforation 27, corresponding to the exhalation pipe 7, there is placed a tube 29 which passes
 15 through the material giving off oxygen and ends, at its lower part, in the free space 30, comprised between the lower sheet 24 and the lower wall of the cartridge, in such a way that a part of the
 20 air exhaled by the user comes directly into the space 30, from which it passes, through the material giving off oxygen and that absorbing the carbonic gas, into the tubing 8.

25 In order to avoid the material absorbing CO₂ blocking up the passage at the right of the perforations 27 and 28, there are arranged between the upper wall of the cartridge and the sheet 25 and
 30 surrounding these perforations, tubes 31 and 32 in metallic sheet or perforated.

In order to permit a regulation of the proportion of air which passes through the material giving off oxygen and the soda
 35 lime, in comparison with the air passing only through this latter, the tube 29 is adjustable in height so as to close up more or less the passage through the permeable
 40 tube 31. This adjustment in height of the tube 29 is obviously effected during the manufacture of the cartridge, and after the tube has been placed in a suitable position, it is fixed in said position, by
 45 soldering for example, to the wire gauzes 24 and 25 between which the oxygen-generating material is disposed.

With a view to permitting the storing of the cartridges, the orifices 27 and 28 are sealed, normally and in an air-tight
 50 manner, by impermeable sheets 33, of tin for example, capable of being destroyed, torn or pushed in by the teeth provided at the ends of the tubes 7 and 8 when the
 55 cartridge is thrust into the radiator and kept in place by the stirrup 19. These sheets 33 could be replaced by internal valves, flexibly applied on the upper wall of the cartridge, and which would be
 60 thrust in by the ends of the tubes 7 and 8 when once the cartridge was in working position.

On the tube 8 there is provided either a cock (fig. 7) or an automatic valve (fig. 6). In the case of a valve 34, this is
 65 prolonged towards the bottom by a rod 35

of such a length that, when the cartridge is introduced into the bottom of the radiator, this rod 35 lifts the said valve 34 in antagonism to a return spring 36,
 70 the end of the rod 35 coming to rest on the upper plate 25 of the cartridge. It is then seen that the air, which has passed through the cartridge and has been regenerated there, can penetrate to the
 75 interior of the jacket 7 or of the auxiliary reservoir, where it is inhaled by the user. When there is no cartridge in position, the valve 34 rests on its seat and prevents the external air from penetrating into the
 80 jacket 1. In this case the apparatus functions through the intermediary of the filtering cartridge 6 in the manner of an ordinary mask.

In the case where a cock is used as shown in fig. 7, the shell 37 of the cock,
 85 of which the body can be formed by the piping 28 itself, can occupy two positions corresponding to the closing and to the opening of the piping 38 respectively.

In the interior of the tube 7 is a valve 40
 90 normally applied to its seat 41 by a spring 42 which is supported on the seat 41 and also on a shoulder 43 integral with the rod 44 of the valve 40. Said valve 40 is adapted to open under the action of the
 95 air exhaled by the wearer and to be closed for passage in the opposite direction, that is to say for preventing the introduction of the noxious, external air into the conduit 12 terminating at the mouth of the
 100 wearer.

It is also obviously possible to provide on the tube 8 a valve similar to valve 40 but operating in the inverse direction, said
 105 valve not being however indispensable on account of the existence of the valve 34, (fig. 6) or the cock (fig. 7).

The working of the respiratory apparatus will be easily understood from the foregoing.
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The user, having placed in position the hooded jacket, puts in a regenerating cartridge and thrusts this into the radiator in such a way as to destroy the sheets 33
 115 which seal up the orifices of inlet 27 and of outlet 28, of the cartridge which could originally be kept in the radiator in a position of non-operation, owing to the stopping seat 21 and the co-acting projection 20. In breathing out through the
 120 tube 12, he compels the exhaled air to pass through the said cartridge and to become regenerated and the air thus regenerated penetrates into the interior of the jacket 1, the automatic valve 34 having been lifted
 125 from its seat or the cock 37 having been brought to its position of opening of the piping 28.

It can likewise be seen that the changing of the regenerating cartridge can be
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effected easily and without danger, the user then bringing the cock 37, when the case requires it, into its closed position for the total duration of the operation of replacement of the cartridge. If the user wishes to make use of his respiratory apparatus with the aid of the filtering cartridge 6, he closes the cock 37 and lowers the cartridge 18 and he then inhales the external air after its passage through the said filtering cartridge 6, as in an ordinary mask and exhales through pipe 12.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. Improvements in regenerative breathing apparatus for protection against noxious fumes, smoke, dust and gases, in which the air regenerator comprises a casing wherein a regenerator cartridge for the exhaled air is disposed in a readily detachable manner, characterised in that the said cartridge is formed of a box containing an oxygen-generating substance, such as a mixture of oxylith and pumice stone in granular form and also a substance which absorbs carbon dioxide, such as soda lime, means being provided for passing a predetermined proportion of the exhaled air directly into the mixture of oxylith and pumice stone and subsequently through the soda lime, and for passing the remainder of the exhaled air directly and solely through the soda lime.

2. Improvements in regenerative breathing apparatus, as claimed in Claim 1, characterized by the fact that opposite the end of the exhalation pipe is arranged

a tube passing through the mixture of oxylith and pumice stone for the passage of the part of exhaled air which is to pass through this mixture, said tube providing between its upper edge and the lower part of the exhalation pipe, a space for the passage of the exhaled air which passes directly and solely through the soda lime.

3. Improvements in regenerative breathing apparatus, as claimed in Claim 1, characterised in that the inlet and outlet orifices of the regenerator cartridge comprise closure means which are opened automatically when said cartridge is brought into the operating position in the regenerator apparatus.

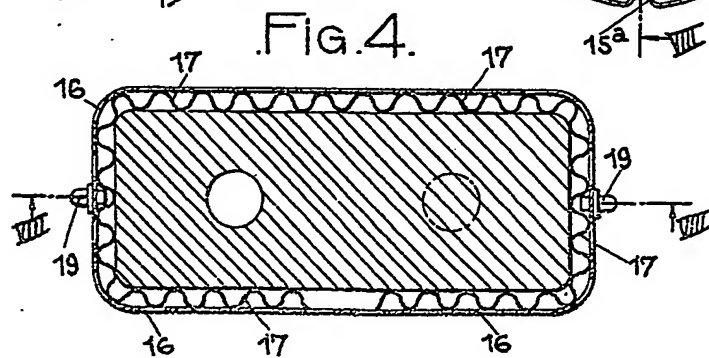
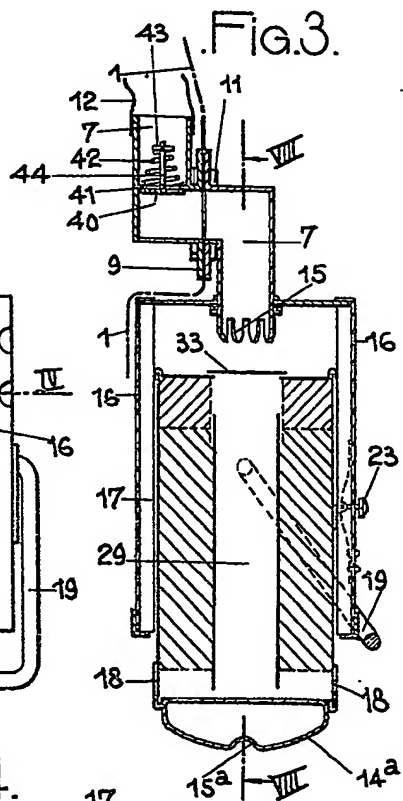
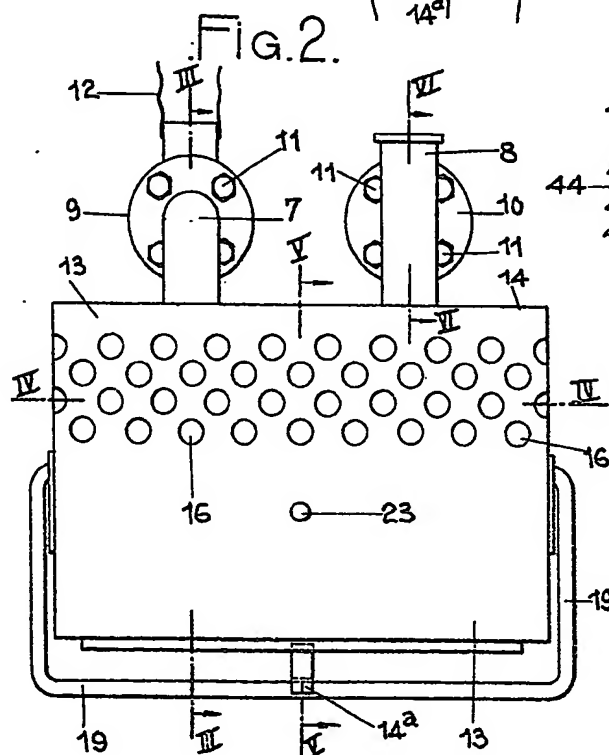
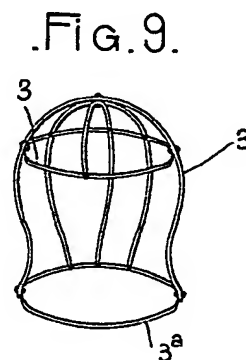
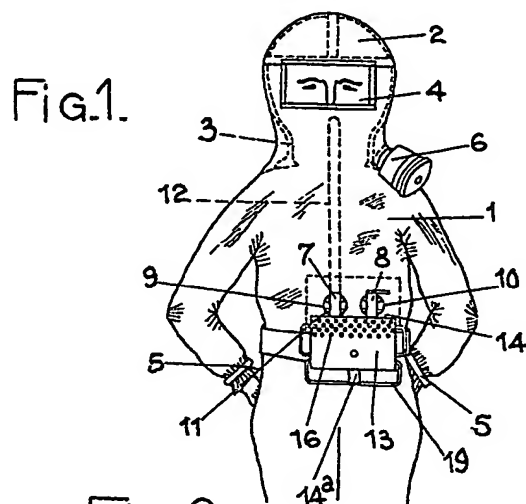
4. Improvements in regenerative breathing apparatus as claimed in any of the preceding claims, characterised in that in order to effect a cooling of the regenerator cartridge during its operation, said cartridge is placed in a casing or radiator comprising appropriate perforations, a perforated metal wall which is a good conductor of heat coming into contact with the outer wall of the regenerator cartridge for increasing the cooling effect.

5. Improvements in regenerative breathing apparatus, as claimed in any of the preceding claims, characterised in that means are provided for maintaining the regenerator cartridge in the apparatus in a position in which said cartridge is not in service.

Dated this 19th day of January, 1937.

HIPPOLYTE ALBERT MARCEL
REGNAULT.

Per Boulton, Wade & Tennant,
111/112, Hatton Garden, London, E.C.1,
Chartered Patent Agents.



[This Drawing is a reproduction of the Original on a reduced scale.]

SHEET 1

Fig. 6.

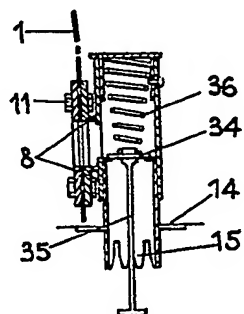


Fig. 7.

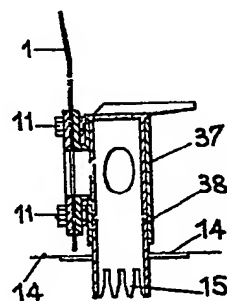


Fig. 5.

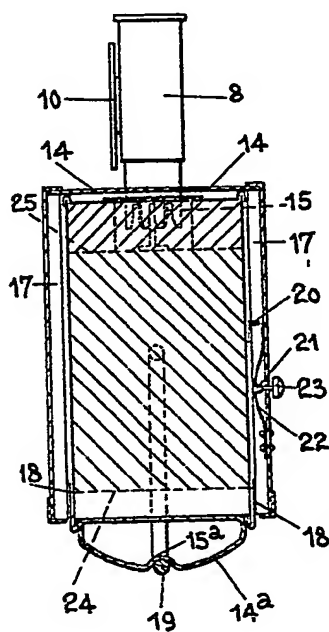


Fig. 8.

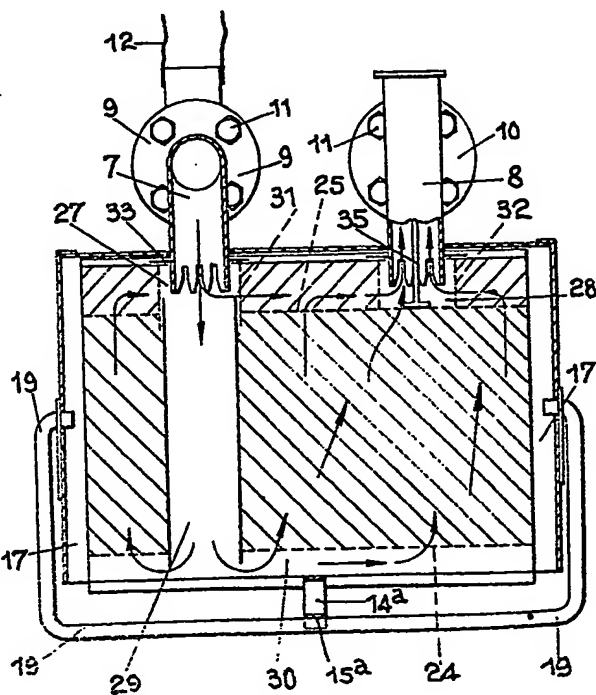


Fig. 1.

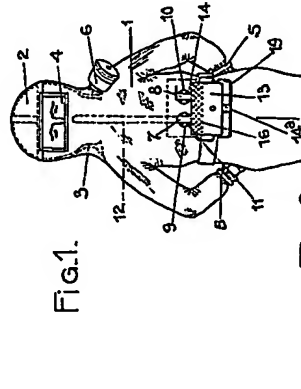


Fig. 9.

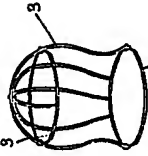


Fig. 2.

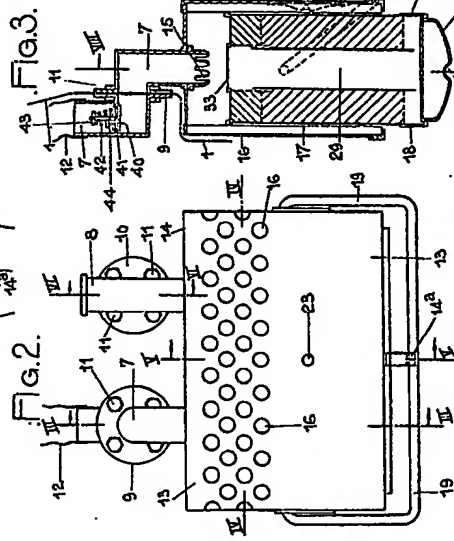


Fig. 3.

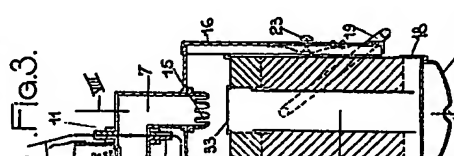


Fig. 4.

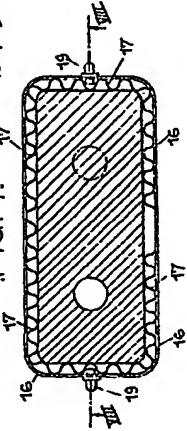


Fig. 6.

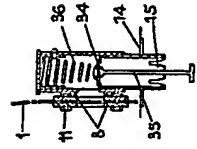


Fig. 7.

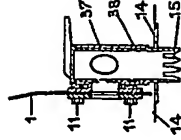


Fig. 5.

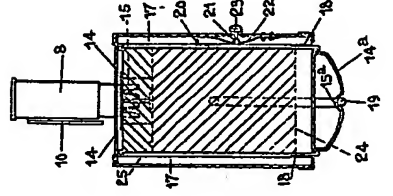
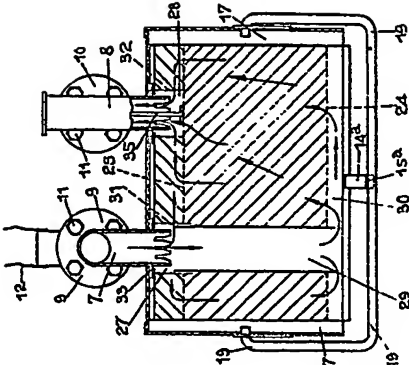


Fig. 8.



[This Drawing is a reproduction of the Original on a reduced scale]